
Carrier fault clearing

Radio carrier system

The considerations for clearing faults in land carrier systems also apply to radio links. The radio link should meet T1 interfacing specifications, and any cable connections between the radio and the RPE should meet the same requirements as for ground links.

Land-line carrier systems

Because of the number of carrier systems available, this section can give only general ideas for clearing faults in carrier systems. Clearing carrier faults requires the following:

- a general understanding of carrier systems
- an oscilloscope
- a carrier line test set
- complete documentation for the carrier system

Figure 4 shows a simplified diagram of the looping options in an RPE carrier system. The system can be partitioned at any of several points to determine whether any component (for example, the ORB or line repeater) is causing the fault. To assist in this, the Meridian 1 RPE system has a facility to inject test patterns at the ROUT jacks in the QPC99 (**Figure 5**).

Figure 4
Carrier looping options

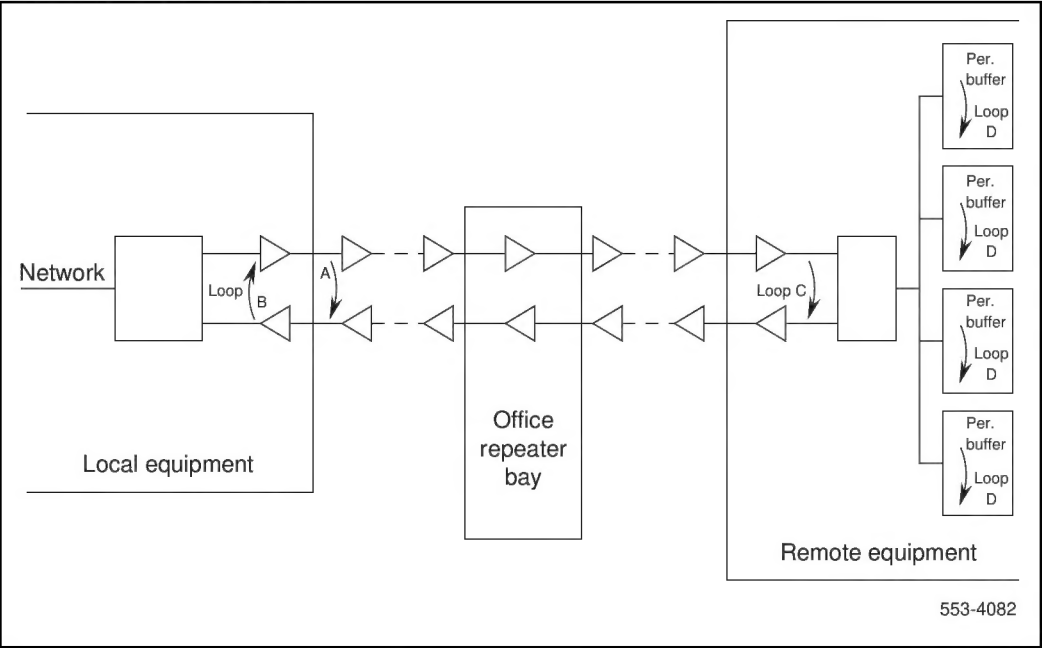
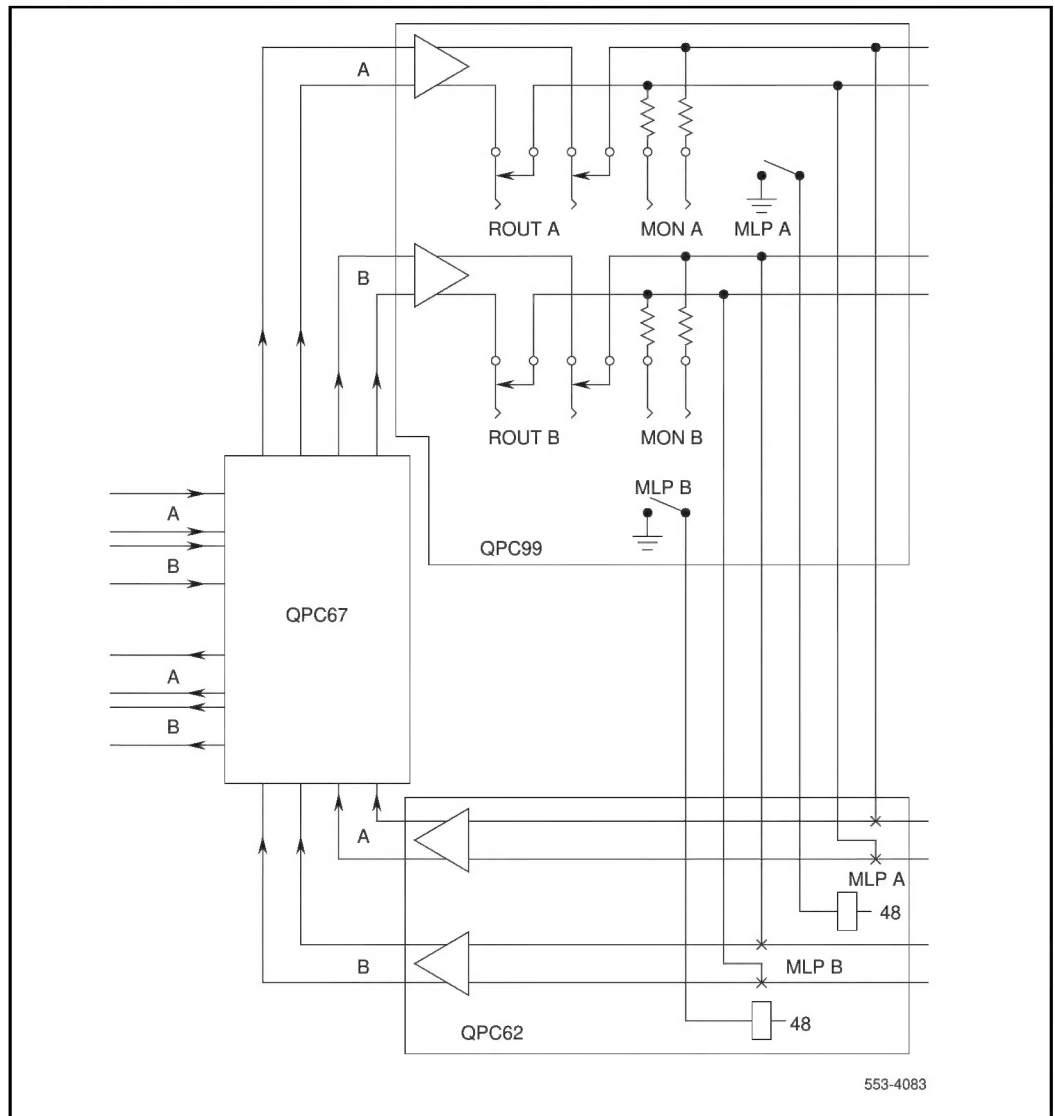


Figure 5
QPC99 maintenance jacks and looping switches



Looping options

An RPE system has several looping options available to aid fault location. These options are illustrated in **Figure 4**.

The system can be tested by looping the signal at the peripheral buffer (Loop D). Load LD 32 and refer to the *X11 input/output guide* (553-3001-400) for a list of available commands.

Common causes of faults

Possible causes of carrier faults can include the following:

- Traffic and pattern changes. Each digital repeater regenerates the clock from the incoming signal. When the loop is idle, a high density of 1s is put into the line, making clock recovery easier. Under traffic conditions the signal density decreases, making clock recovery more difficult. If faults occur when traffic is increased, there may be one or more marginal repeaters in the carrier system, or the clock recovery circuit at one or both RPE ends may be mistuned.
- Shortened or partially grounded cable pair.
- The output from the local transmitter can be looped back into the local receiver (A). Load LD 62 and see the *X11 input/output guide* (553-3001-400) for the appropriate commands.
- The carrier can be looped manually and tested from the ORB (B + C), depending on the type of carrier system used.

Carrier looping options include the following:

- loop when the error rate exceeds one in 10^4
- loop when DC is detected on the FLP and error rate exceeds one in 10^4
- loop when the manual loop back (MLP) switch on the QPC99 is closed

The MLP switches on the QPC99 allow the signal from the QPC99 to be put directly back into the carrier line and monitored at the far end using the monitor (MON) jacks on the QPC99 at the far end.

These options are switch-selectable on the QPC99. The use of fault-locating filters is outlined in the Northern Telecom Publication for the LD-1 carrier system. Whichever carrier system is used, documentation for it should be obtained and used to assist in the fault-clearing process.

Problems such as the following may be encountered at the repeater site itself:

- faulty repeater
- faulty cable pair at the input to a regenerative repeater, wherein signal errors are arriving from the line
- faulty cable pair at the repeater output toward the next repeater location, causing reflections and poor impedance characteristics, which result in errors at the repeater
- faulty simplex power loop, causing degraded repeater performance or complete failure
- faulty wiring in the repeater housing, sometimes encountered during pre-service testing

Error measurement

The performance of a pulse code modulation (PCM) system can be observed either “by eye” using an oscilloscope or by using a test set to measure error density.

For voice traffic, a PCM system with 10^{-6} (one error in a million bits) performance is generally considered excellent. With 10^{-5} , clicks may be heard, and 10^{-4} performance results in pops, clicks, and noise. At 10^{-3} most PCM systems go into alarm condition. (At this point, there is one error in only 1000 bits.)

For data traffic, any system performing at less than the 10^{-6} level causes the following problems for customers:

- Cross talk. Every cable has its limits on the number of PCM systems that can be safely operated in the same sheath without intersystem interference. Cross talk causes errors because of the regenerator’s inability to decide whether an induced signal constitutes a “pulse” or not. This shows up as pops, noise, and data transmission errors. The most common cross talk path is within the repeater housing and within the cable near the repeater itself because of the large difference (32 dB or more) between the outgoing and incoming signal.
- unbalanced cable pairs
- load coils, bridge taps, or building-out capacitors not removed
- moisture in cable
- defective lightning protection devices
- crossed cable pairs
- open or very high resistance cable pairs or splices (continuity tests may help in locating this)

When inspecting the waveform on the oscilloscope at various points in the carrier span, keep in mind the requirements listed in *Remote Peripheral Equipment description, installation, and testing* (553-2601-200), since any deviation from the limits listed there causes errors or contributes to them.

Meridian 1

Remote Peripheral Equipment

Maintenance procedures

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Publication number: 553-2601-500

Document release: Standard 3.0

Date: December 1994

Printed in the United States of America